Ex. the non-degenerating form follows "up to" transformation, reflection, and rotation.

Name	Equation
Ellipsoid	$\frac{x^2}{a} + \frac{y^2}{b} + \frac{z^2}{c} = 1$
Cone	$\frac{x^2}{a^2} + \frac{y^2}{b^2} - \frac{z^2}{c^2} = 0$
Elliptic Paraboloid	$\frac{x^2}{a^2} + \frac{y^2}{b^2} - \frac{z}{c} = 0$

Ex. $x^2 - y^2 - z^2 - 4x - 2z + 3 = 0$

① Rewrite $\quad 0 = x^2 - y^2 - z^2 - 4x - 2z + 3$

$$0 = (x^2 - 4x + 4) + (-y^2) + (-z^2 - 2z - 1)$$

$$0 = (x-2)^2 - y^2 - (z+1)^2$$

Let's understand the cross-section of this picture with respect to (wrt) the coordinate planes (shifted)

when $z = k$ (constant)

i.e. $(x-2)^2 - y^2 = (k+1)^2$ | hyperbola

when $y = k$

i.e. $(x-2)^2 - (z+1)^2 = k^2$ | hyperbola

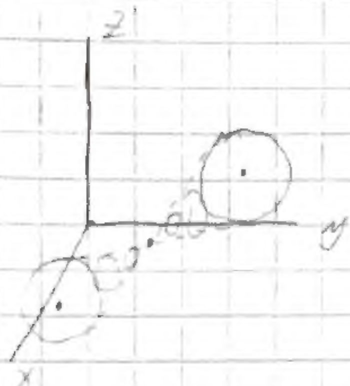
when $x = k$

$y^2 + (z+1)^2 = (k-2)^2$ | ellipse

Conic Sections

$\frac{x^2}{a^2} + \frac{y^2}{b^2} = \cancel{z^2}\ 1$	ellipse
$\frac{x^2}{a^2} - \frac{y}{b} = c$	parabola
$\frac{x^2}{a^2} - \frac{y^2}{b^2} = c$	hyperbola

Picture:



Section 13.1 Space Curves

A space curve is a function

$$\vec{r}: I \to \mathbb{R}^2.$$

Ex. The Helix is the space curve

$$\vec{r}(t) = \langle \cos(t), \sin(t), t \rangle \implies$$

shadow in x-y plane 

Defination: Limit of a space curve

$$\vec{r}(t) = \langle x(t), y(t), z(t) \rangle$$

at $t=a$ is the componentwise limit if they all exist.

$$\lim_{t\to a} \vec{r}(t) = \lim_{t\to a} \langle x(t), y(t), z(t) \rangle = \langle \lim_{t\to a} x(t), \lim_{t\to a} y(t), \lim_{t\to a} z(t) \rangle$$

$4+\sin(20t)\cos(t), [4+\sin(20t)]\cos(t),$

Ex. Compute the limit of $\vec{r}(t) = \langle \cancel{4+\sin(20t), 4+\sin}\ \cos(20t) \rangle$ at $t = \frac{5\pi}{8}$.

$F: I \to \mathbb{R}^n$

The limit of $F(t)$ is completely computed wise